
X -ray Security Inspection Equipment

Instruction

I Introduction

The channel type X- ray security inspection equipment developed by our company is a inspection system that uses the penetrated ability of X -rays to quickly inspect the baggage, cargo without unpacking. Channel type X- ray security inspection equipment is an advanced X -ray image detection system, which combines the advantages of the efficient semiconductor detector, digital image processing technology and computer graphics display, to provide users with a reliable and efficient image processing system with high-quality and services function. The hard disk capacity of this device can store any multiple high-definition images, with reliable automatic alarm function for dangerous goods and automatic error detection and maintenance function, adopting a simple user-friendly operation design, which enable the users to operate easier and faster.

In order to let the majority of users have a comprehensive understanding to our products, and to provide the maintenance personnel with the necessary repair reference materials, we especially prepare the user manual of channel type X- ray security inspection equipment. This manual comprehensively describes the working principle and how to operate, as well as adjustment, maintenance and repair of the channel type X- ray security inspection equipment. Please read this manual carefully before installing and using the product; our company won't take any responsibility if the users do not comply with the requirements and damage the equipment.

Since the channel type X- ray security inspection system's single check and ray leakage are very low, the national standard is $5\mu\text{Gy/h}$, while the amount of leakage of our equipment offered less than $0.1\mu\text{Gy/h}$, so this product is absolutely safe for the operators, passengers and for all the carried commercial films. Even so, it is recommended that carefully read the user manual before using this product, since this manual contains the important information about the safe use of channel type X- ray security inspection equipment. The product should be operated by those personnels

that have received formal training, in any case, the operators must strictly comply with the ray protection rules to avoid any radiation risk, and only those personnels that have received the training of radiation safety and system operation can use the channel type X- ray security inspection equipment.

Due to time constraints, this manual inevitably exists omissions and deficiencies, so we'd like to accept the criticisms from the majority of users and experts.

Our products have been continuously improved, so we will revise this manual without notice.

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I System Overview

Chapter 1.01 1.1 System working principle

Channel type X- ray security inspection equipment consists of baggage handling section, X-ray source and control section, signal acquisition and processing, as well as transmission parts, the image processing part and electrical control parts. Channel type X- ray security inspection equipment uses the conveyor belt to take the baggage into the crawler channel for checking. After the goods getting into the channel, the relevant information will be sent to the control unit by the detection device, then the control unit triggers the X -ray source to emit X -rays. The X -ray is formed as a very narrow fan beam through collimator, then fall into the detector after penetrating baggage on a conveyor belt, the detector transfers the received X -rays into electrical signals, the weak current signals are quantified after amplification, and transmitted to the industrial control computer for further processing through a universal serial bus, after a complicated calculation and image processing, to obtain high quality images. Figure 1.1 shows how it works:

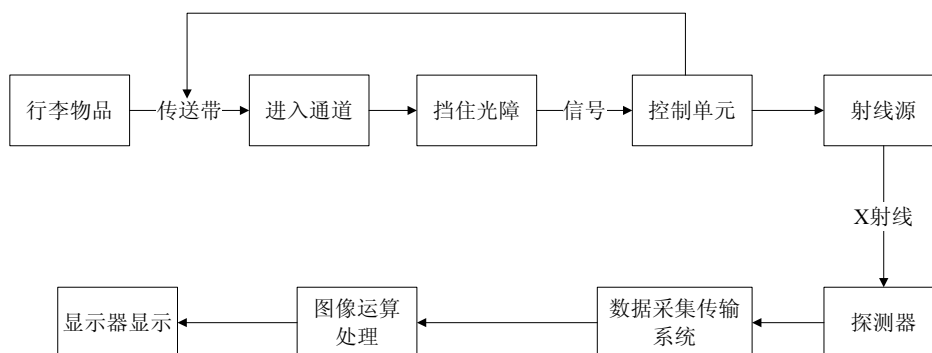


Figure 1.1 X -ray security inspection equipment working principle picture

Chapter 1.01 1.2 Product Features

This product has the following characteristics, to provide users with a more convenient and efficient service.

- ★ Environmental lead curtain: the surface of lead curtain is treated particularly, which make it wear and environmental protection, extended service life
- ★ Network interface: can connect to the LAN, multiple terminals simultaneously check the baggages
- ★ Ray safer: ray emission automatic control, to avoid inadvertent transmission
- ★ A key shutdown control: just rotate the key when turn off the device, it will turn off automatically and safely, simple and convenient
- ★ Dynamic processing functions of image: some function keys can realize real-time processing in a dynamic status

Chapter 1.01 1.2 Technical indicators

Integrated product technical indicators are as follows :

☆ The basic parameter index:

Channel dimensions	5030C Model: 500(width)× 300(height)mm	[	]
	6550 Model: 650(width)× 500(height)mm	[	]
	8065 Model: 800(width)× 650(height)mm	[	]
	10080 Model: 1000(width)× 800(height)mm	[	]
	100100 Model: 1000(width)× 1000(height)mm	[	]
OEM	6040 Model: 600(width)× 400(height)mm	[	]
OEM	6575 Model: 650(width)× 750(height)mm	[	]
Conveyor speed	0.20m/s		
Conveyor rated load	5030C: 100 kg		
Penetration	5030C: 32mm steel sheet; 6550: 34mm steel sheet		
Film Safety	ISO1600 film safety		

Leakage dose 5030C model: $\leq 0.1 \mu\text{Gy/h}$

☆ X-ray Generator:

Ray beam direction	bottom -illuminated type
Tube voltage	140kV (adjustable)
Ray beam divergence angle	80°
Cooling / work cycle	Sealed oil cooling / 100%

☆ The image processing system:

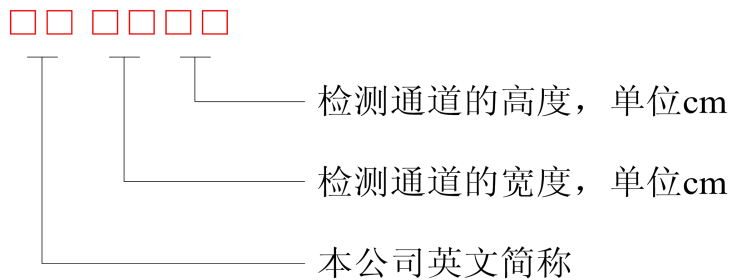
X-ray sensor	L-shaped photodiode array detector, 12bit depth
Monitor	High-resolution 17-inch monitor
Color image display	According to the material substance, 24-bit true color display
Edge Enhancement	The edges of objects outline become more clear
Super image enhancement	The details of image become more clear
High penetration display	Improve image contrast in bright areas, so as to make the area that be easy penetrated more clearly.
Low penetration display	Improve image contrast in dark areas, so as to make the area that be difficult penetrated more clearly.
Magnifier	Local amplification, dynamic zoom display
Brighten / darken	Increase image brightness / reduce image brightness
Image pull back / front pull	Display former 20 images, and the current image can be taken any image processing
Image restoration	The image displays that it is restored to its original state
Image storage	Real-time save any image, any image can be processed, continuously working to save.
Color	Organics is shown in orange, inorganic in blue , the mixture in green

☆ Environment:

Operating temperature / humidity	0℃～45℃ / 20%～95% (Non-condensing)
Storage temperature / humidity	-20℃～60℃ / 20%～95% (Non-condensing)

Operating Voltage	220VAC(±10%) 50±3Hz
Power loss	1.0KW-1.5KW (Max)
Noise level	<58dB

Chapter 1.01 1.3 Composition and representational meaning of models



Chapter 1.01 1.4 Main purpose and scope of application

Channel type X- ray security inspection equipment using the latest imaging technology, higher resolution display, clearer images, can quickly and efficiently detect the dangerous goods, which are widely used in government agencies, embassies, airports, convention centers, exhibition centers, tourist attractions, sports and cultural venues, post offices, shopping malls, hotels , schools and other security checks occasions, suitable for bags, suitcase , bag and other bags testing.

II Operation Safety Guide

Chapter 1.01 2.1 Regulatory requirements

Channel type X-ray equipment with radiation in product design , has been trying to ensure the high secure of system use, installation and maintenance personnel. Even so, when use, install and carry out the maintenance of this equipment, users must comply with the following safety rules:

- 1、GB 15208—2005 *“Micro- dose X-ray security inspection equipment”*.
- 2、GB 4208—93 *“Degrees of protection provided by enclosure (IP code)”*.
- 3、GB 18871—2002 *“Ionizing radiation protection and basic standards of radiation sources safety”*.
- 4、*Radioactive Pollution Prevention Law of the PRC*

Chapter 1.01 2.2 Basic safety rules

Although the channel type X -ray security inspection equipment is easy to operate, we still recommend that you read this manual before you turn on the equipment, and comply with the following rules:

- 1、If more than six months without use the equipment, please do not turn on it! The X -ray generator must be restarted by professional and technical personnel firstly, otherwise it may cause damage to the X-ray generator !
- 2、Before operating the channel type X -ray security inspection equipment, you should be aware of the applicable provisions of the radiological protection!

3、 If other people want to operate your channel type X -ray security inspection equipment, it must ensure that he is a qualified operator, who understands all safety instructions , laws and regulations.

4 、 Installation, electrical connections and replacement of mechanical and electrical components of the channel type of X -ray security inspection equipment can only be done by an experienced professional and technical personnel!

5、 If the enclosure components , cables or conveyor belt of this equipment are damaged, it must cease operation immediately!

6、 The shell plates and parts of channel type X-ray security inspection equipment can only be opened by qualified professional and technical staff !

7 、 Do not modify , change any part of the system security. Installation, commissioning or maintenance of equipment can only be done by trained and qualified personnel.

8、 Channel type X -ray security inspection equipment only can be used to check items,but not human or other organisms!

9、 Prohibit sitting or standing on the conveyor belt.

10 、 When start the channel type X -ray security inspection equipment, it is prohibited that any part of the body getting into the channel!

11、 Ensure that baggage in the detection channel or outlet end is not stacked! If baggages block the checking channel, you should turn off the equipment before cleaning the channel.

12、 Prevent all kinds of liquid from getting into the machine, if this happens, you should turn off immediately.

13、 The vents on the channel type X -ray security inspection equipment and on the monitor can not be blocked!

14、 Must be grounded before the system work. Mains socket and the installation site must have a reliable ground configuration.

15、 When the device is working, people are not allowed to stand at the exit, near the entrance channel.

16、 If the lead curtain is damaged or opened, you can not make the device work .

17、 Although the X -ray dose is small, non-staff need to stay away from the device .

Chapter 1.01 2.3 Security inspection of the equipment

Before using the equipment, it should ensure the following safety inspections:

1、 The lead curtain used to prevent leakage of X -rays at the entrance and exit of channels must be checked before the system power is turn on, if damaged, replace it immediately.

2、 Check if there are objects blocking the light barrier.

3、 Check the conveyor belt is intact, whether it is seized by luggage spikes and smudges, whether it is deviated or stuck.

4、 Check the enclosure panels , monitors, keyboards and cables of your X -ray security inspection equipment whether is damaged or not.

5、 Make sure that all covers are closed.

Chapter 1.01 2.4 X -ray security

X -ray security inspection equipment, takes a reliable protective measure for the X -ray radiation, effectively ensure the safety of operational and detected persons. These measures are:

1、X -ray source used by system is active components, which can emit the X -ray only under high voltage, thus if there is no power, such as transportation and storage, it can not emit the X-ray.

2、The cabinets and the collimator shielding stereotype, access ports are equipped with lead curtain, which effectively prevent the X -ray damage.

3、To ensure the safety of maintenance personnel, two interlock switch (if turn off any of the interlock switch, it will not emit X -rays), when the conveyor is stopped and there is no items in the channel, it will not emit X -ray emission, so as to prevent maintenance personnel from the X -ray damage.

4、Set ground equipment in multiple locations, so as to effectively prevent electric shock and equipment damage.

5、The equipment internal is installed with overload, over-current multiple protection, so as to minimize the likelihood of accidents and risks.

6、The X -ray security inspection system is fully in line with the security requirements of X -ray national standard GB15208-2005.1.

Channel type X- ray security inspection equipment is designed to protect the safety of operational and maintenance personnel in any case. The system has a very low X -ray dose, while ensure there is enough penetration for checking the goods, and the photographic materials, food, medicine and tapes are unaffected, even repeated exposure anyway. The device is equipped with a large area of lead shielding to prevent X -ray leakage. Almost a lead curtain will reduce the external ray radiation to zero. The exit point and detector box of X -ray are equipped with safety interlock switches, and control circuit monitors their work at any time. Either interlock switch is off, the device will automatically cut off the AC power of X -ray controller, thereby turning off X -rays. The X -ray source of this device can not emit X -ray after the power off.

Chapter 1.02 2.5 Informed information



1、 Any device that produces X -rays are harmful, so please try to reduce exposure to radiation environment time and pay attention to protection!

2、 The external power grid, power supplied, must have a good grounding, and truly connect with the earth .

III System Architecture

Chapter 1.01 3.1 System components

System consists of hardware and software two components.

Hardware includes:

- (1) X -ray generator controller
- (2) X -ray detector
- (3) Data collection device
- (4) Mechanical device
- (5) Industrial control computer and display device

Software includes :

- (1) The system control section
- (2) The image processing section

The diagram of the system components is as follows:

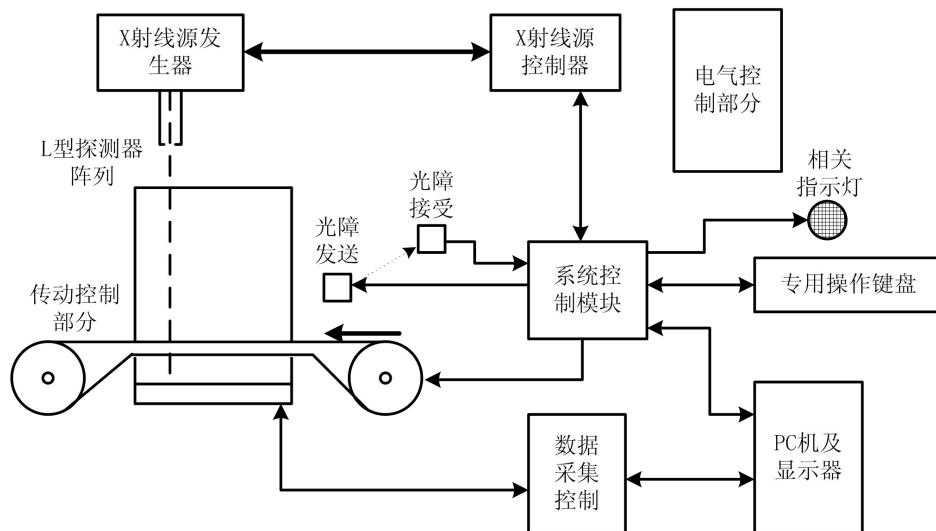


Figure 3.1 the diagram of system components

Chapter 1.01 3.1 System components and subassemblies

Components and sub- components of the system include the following:

- (1) X -ray source
- (2) X -ray source and the drive control means
- (3) X -ray detector array cartridge
- (4) The electronic control unit
- (5) IPC
- (6) Monitor
- (7) Intermediate relay
- (8) Key switch
- (9) Cooling fan
- (10) Conveyor
- (11) Light barrier
- (12) System powered devices

Chapter 1.01 3.2 System sub-components' functional description

(a) 3.2.1 X -ray source

X -ray source consists of three parts :

- (1) high-voltage generator (two high-voltage and feedback circuit)
- (2) X -ray tube
- (3) collimator

Put the high-pressure generating device that consists of X -ray tube, two voltage doubler and a feedback circuit into a shield that filled with oil and lead, the cable WS9 provides X -ray source with filament and the high voltage drive signal, and send the sampling signal information of high voltage and anode current back to the X -ray control and drive chassis, to remain the stable high voltage and anode current during the inspection period. The effect of the collimator is to transfer the X-ray beam into a

fan beam.

(b) 3.2.2 Detector array box

Two L-shape formed in the detector array to resolve the problem of blind spot detection. Vertical side (hereinafter referred to as the detection side of the cartridge) and horizontal side (hereinafter referred to as the bottom probe box) each has plurality of detectors plates, each plate comprising 32 channels. High , low-energy analog signal after being amplified in the probe board, then carry out digitizing and transmitted to the industrial control computer for processing.

(c) 3.2.3 Electronic control box

Control board is responsible for receiving instruction of industrial control computer, controlling the motor running and stopping, monitoring the state of the light barrier, judging the enter and leave of the baggage, controlling the X-ray emission and turn off, monitoring the X-ray, controlling module is working properly, such as abnormal, then automatic alarm.

(d) 3.2.4 The image processing system

The image processing system is realized by industrial control computer. Computer receives data from the detector signal collection and transmission system for data processing.

(1) image processing functions

Image processing features of the device include edge enhancement, super image enhancement, color, anti-color display, local penetration enhancement, image pull back, and amplification.

(2) data storage and retrieval functions

The device supply with the functions of storage images, retrieve images and

recording operation of the operator.

(e) 3.2.5 The display device

The system uses 17 inches high resolution display, according to the need to display color images or black and white images.

(f) 3.2.6 Delivery device

Conveying means comprising:

- (1) the conveyor belt;
- (2) a motor (drive) roller located at the outlet end of the conveyor;
- (3) a idler pulley located at the inlet end of a conveyor;
- (4) a roller located below the belt running direction.

The motor roller includes a single- phase motor, the motor drive torque is transmitted to the roller surface through the gear reduction mechanism, forming the driving force of the belt, the idler pulley is used for the belt tension adjustment .

(g) 3.2.7 Light barrier devices

At the entrance of channel is equipped with a light barrier device (beam photoelectric switch), to check the baggages that are sent by the conveyor belt to channel, if luggage blocking light barrier, the light barrier receiver output signal to the electronic control unit, the control unit notifies the controller to start transmitting the X -ray radiation.

Chapter 1.02 3.3 System Software

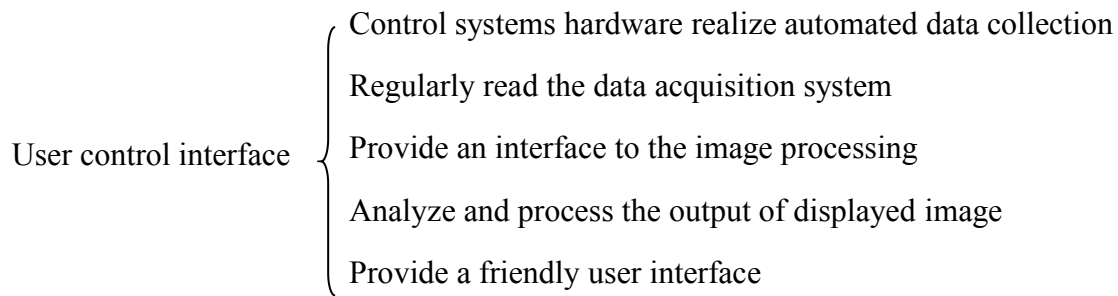
(h) 3.3.1 Software operating environment

Software operating environment is Microsoft Windows XP version.

(i) 3.3.2 Software introduction

Software consists of the following two parts:

- (1) specific drivers
- (2) user control interface



The software carries out the complex data processing for the transmitted signal, and display the processed image on the screen, for the operator to identify. Software provides edge enhancement, anti-color display, pseudo-color, partial penetration enhancement and other image processing functions, facilitate the identification of prohibited items , and has pulled back images, zoom functions, such as image processing and image storage function (50,000 or more).

IV Electrical construction of the equipment

Chapter 1.02 4.1 Electrical control

Electrical system is an important part of the security system, which mainly supplies the power to the entire security system, but when an accident happens, which can provide appropriate protection for the electrical systems, the equipment is operating personnel operating control in the stage of the equipment, the principle schematic of electrical section as shown in figure 4.1.

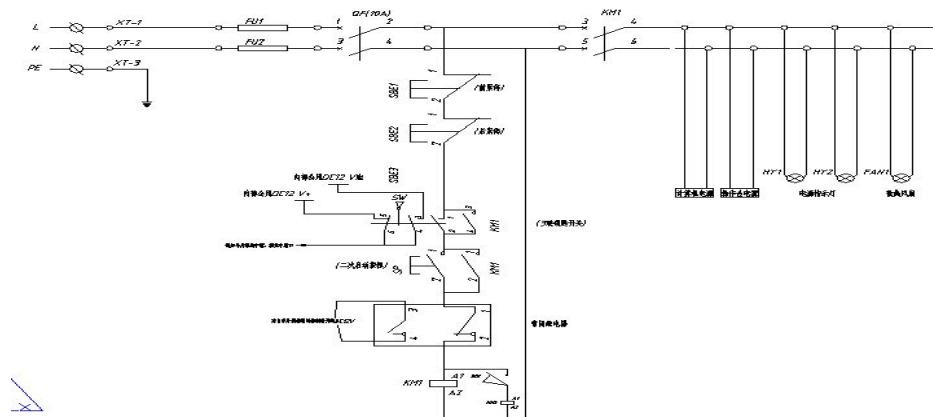


Figure 4.1 Schematic of electrical section

The electrical section has following main functions.

Chapter 1.02 4.2 Overcurrent

In Figure 4.1, FU1, FU2 are solid fuse of 10A respectively, the actual power of device is 1500W, designed for a maximum power of 2200W, which meets the maximum power requirement; the circuit breaker is closely followed in the fuse, so

that it can instantly trip, play a protective role when there is short circuit occur, chosen for Chint QF, model DZ47. The reasons of short circuit mostly are internal reasons, such as insulation aging, loose terminal connections caused by short-circuit power, and human factors .

Chapter 1.03 4.3 Emergency protection

Figure 4.1 , SBE1, SBE2 are emergency stop button, this switch is placed in the vicinity of the operating personnel and security equipment enclosure, to prevent the occurrence of unexpected events, which can be powered down immediately. Connected to the main circuit control section, the model selected as the diameter of 22 , the current is 10A, to meet the needs of the device.

Chapter 1.04 4.4 Access control

This equipment is operated by trained, full-time staff. Non-staff can not operate, so there must be access control, there are two programs, one in the electrical, the other in software, Figure 4.1 SW key switch to achieve, it is connected in series to the main control loop, choose 2 as normal open, 1 as normal closed switch. Only get the key switch, you can use the device, which prevent others from false triggering device.

Chapter 1.05 4.5 Remote start control

Using remote start control, place the control buttons on the operating table, and separated from the main equipment, the console can be placed in a room or other needed place, to extend the controls carried out by an extension cord, so that the remote can be controlled.

Chapter 1.06 4.6 A key shutdown control

In practical applications, there are following cases of the above-described key switch: the operator misuse, directly reverse rotation of the key switch, causing the main circuit power. Or accidentally leaving the key switch off. Thus the load , such as a computer, a power outage, has a great impact. Our product just use a rotary key switch to achieve the actual shutdown safely, realizing a key shutdown control function.

Chapter 1.07 4.7 Motor reversing control

In normal use, it needs to rotate the motor positive and negative, such as when in the self-test, if the object blocking the light barrier, the belt needs to carry out positive and negative rotation according to the situation, or when an object that can not be seen clearly, it needs to fall back, to achieve reverse function. The intermediate circuit portion is achieved by a reversing relay.

Chapter 1.08 4.8 Motor thermal protection

Motor will occur over- current if its use time is too long or it is overloaded, so the motor must be protected when the current reaches a certain level.

Chapter 1.09 4.9 Limit switch

Limit switch is mainly to protect human security, because rays are dangerous, when the body hit the X-ray emitting device, it should immediately stop the X-ray emission; limit switch is mounted next to the control of X -ray generating device, connected in series to inside of X -ray generating device, having the effect of

short-circuit protection.

Chapter 1.10 4.10 Each indicator

Lights need to be installed in various parts of the outer surface of the device, playing the role of the instructions for the users, they are X -ray lights, warning lights and power indicators.

(1) Power indicators: turn on the key switch, to make the system power, starting equipment. Green power indicator on the front panel channel will light immediately .

(2) Ray emission indicators: X -ray emission indicators are mounted on the inlet and outlet of the channels panel. After the object getting into the channel and blocking the light barrier, emit X-ray, the red light is on.

(3) A yellow warning light: there is each one in the entrance, when there is suspicious items, it will flash and alarm.

Chapter 1.11 4.11 Terminal module

In a system, each terminal using import terminals UK3.5, through the trough, galvanized wires in a circuit board, carried around with trunking traces. As shown in Figure 4.2 .

V Image Processing and Software Guid

5.1 Turn on

- Insert the key into the key switch and turn it clockwise , then press the green start button to hear the device start, waiting to start .
- Turn on the indicator on the device .
- The system automatically enters the software application interface.
- The program automatically checks whether a foreign body is inside the channel. If a foreign body, the belt will rotate it to the outlet. When the foreign body cleared, the entire software system initialization is complete.

5.2 Carry out goods inspection

- Place the seized items on the conveyor belt for checking.
- Press the " belt forward" buttons to control the motor running, start the transfer belt .
- Once the object enters to the check channel, firstly block the light barrier, so as to start the X -ray generator.
- When the object enters to the check channel, the device will carry out scanning, the corresponding detected image is displayed on the screen in real time, transfer the image from right to left.

5.3 Image processing

(j) 5.3.1 Color / monochrome display

Click the " Color / B & W " button, you can toggle the two colors. The color images are 4 kind of color images, the scanned objects are divided into four categories, namely orange representatives organics, blue represents inorganic, green represents a mixture, black (or red) indicates uncertain material properties, generally refers to the

impenetrable objects. The black and white images has 256 levels of gray, from pure black to pure white in gray-scale display. More white (gray larger) represents an image region of the object absorbs low X -ray, namely more penetrating radiation. The objects with different absorption rate is corresponding to different gray levels. When operate "color / gray " button, it can carry out the display conversion between color and gray scale images.



Figure 5.1 Color / black and white image contrast

(k) 5.3.2 Anti-color images

In the image display, generally the objects with high absorption rate of X-ray appear as dark, with low absorption rate appear bright white. In the highlight, it is in opposite. Click the " anti-color " button, the display can be switched as positive and negative, thus the small or thin high-density objects (such as wire) will become more clear. When operate "anti -color " button, it can carry out anti -color operation between color images and gray scale images.

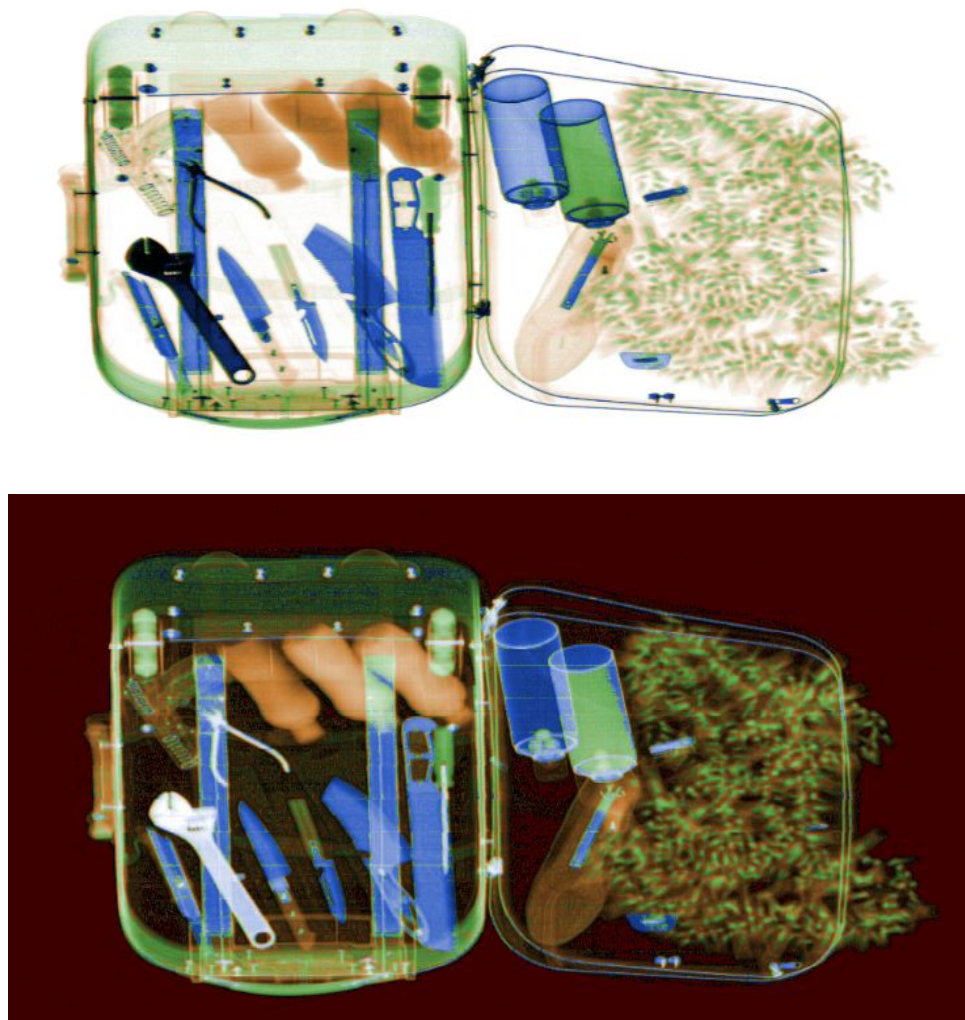


Figure 5.2 Normal / anti-color image contrast

(l) 5.3.3 Edge Enhancement (side enhancement)

When need to further interpret the edges of objects, press the " edge increases " button, the edges of objects in an image is highlighted, which make it easy for operator to distinguish different objects. When press " side increased " button, it can carry out the edge operation for color image and gray scale image.

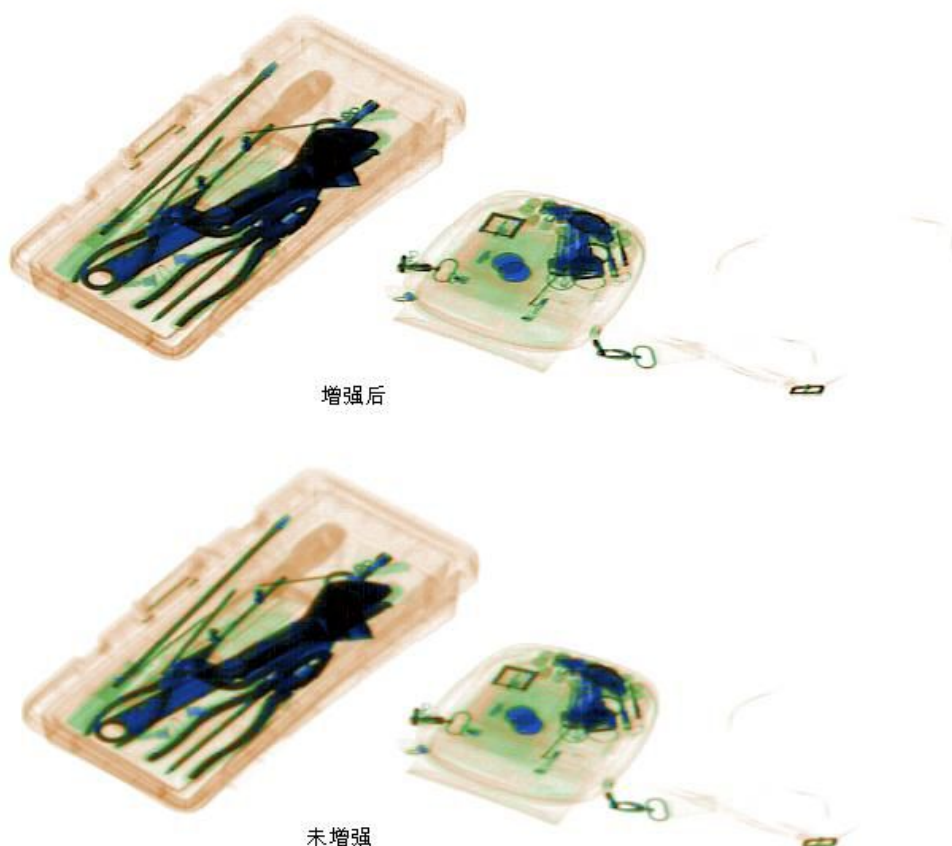


Figure 5.3 Enhancement effect of image edge

(m) 5.3.4 Image local enhancement (local enhancement)

Brighten the dark areas in the image, so as to show clearly the object hidden behind the thick objects, while the normal areas of the image will not be affected. When press this button, the image is switched automatically between normal display and local enhanced display. Secondly press (or "restore" button) to stop the display

switches.

(n) 5.3.5 High penetration strengthen (high penetration)

Figure 5.4 shows the regions that have strong penetration are brighter, but whose contrast is smaller, operate lighter areas with a suitable contrast display through the " high penetration " operation, clearly shows the regions with the high penetration, but normal areas are affected at the same time, and the contrast is reduced.



Figure 5.4 Enhancement effect of high penetration

(o) 5.3.6 Low penetration strengthening (low penetration)

Figure 5.5 shows the regions with low penetration are darker, not easy to be observed, lighter these areas and increase their contrast through the " low penetration

" operation, clearly shows the image of the region, but normal areas are affected at the same time, and the contrast is reduced.

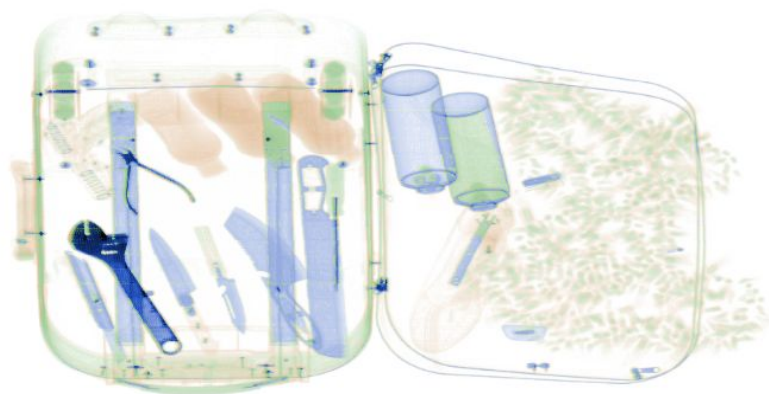


Figure 5.5 Enhancement effect of low penetration

(p) 5.3.7 Highlight organic (organic)

The effect of this operation is to display inorganic substance (blue part) with gray scale, orange part (organic substance) is highlighted, which make it easy for operators to recognize the explosives, drugs, gasoline and other flammable materials.

(q) 5.3.8 Highlight inorganic (inorganic)

The effect of this operation is contrary to organic highlighted display, that is displaying the orange section (organic matter) with gray scale, inorganic section (blue part) is highlighted, which make it easy for operators to recognize the turret, guns and gas cylinders and other items.

(r) 5.3.9 Enlarge image

Continuously amplify the entire image area, while there is a thumbnail image in

the lower right corner, when magnify it, there will be a red box displaying the current full-screen image area. The movement key can move and display the enlarge image area.

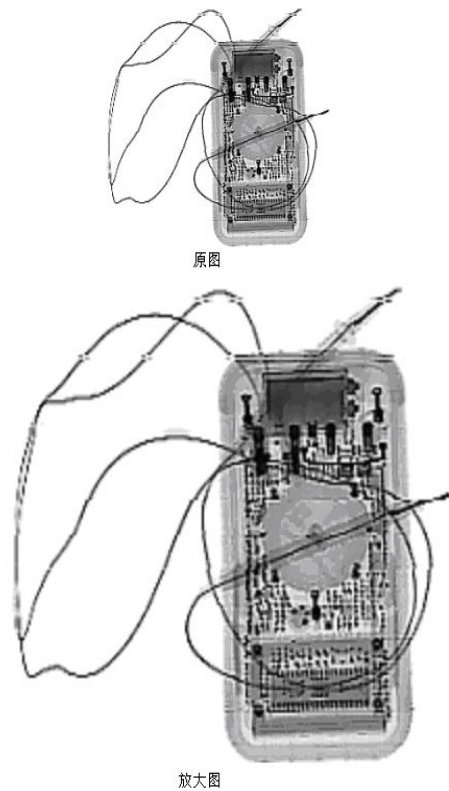


Figure 5.5 image zoom effect

(s) 5.3.10 Grayscale scanning (gray scanning)

Press this button to automatically transform the gray image mapping, it will gradually brighten dark areas, while the bright areas will become gradually dark, which makes it easy for operator to find the best image contrast and brightness effect that most appropriate to the current image.

5.4 Off exit

- Sure not to leave any baggage on a conveyor belt. If necessary, operate the

belt forwards or backwards until there is no goods left on the conveyor. Turn on the indicator on the device.

- Rotate the key switch on left directly, the computer will shut down safely without any other operation, which is very simple, user-friendly designed, and realize the true meaning of "one key off " feature.
- Unplug the key , work off or turn the work to others.

5.5 Software operational guide

Software includes 8 sub- menu, such as login / register menu, which the user can log in, then the user ID will be displayed in the status bar after logging, only can register low -level user rights than the current user, this menu also has the item of software license, as for the limited version of the software, you need to send the information to the registered manufacturers, to get the serial number; document setup menu to check the history of the image; probe point settings menu to set the number and location of detectors; time curve menu to see the response of each detector; image settings menu to set the real effect of the images; function settings menu, there are some auxiliary functions in this menu; hardware configuration menu, the setting of set -ray source and the control panel communications port; information tips menu, manufacturers information and over packet information.

(t) 5.5.1 Actions menu

Operation menu interface is as follows:

Figure 5.6 Operation menu interface

(u) 5.5.2 User login

After the user and the password is set, you can log in, such as the following figure, number column is the corresponding user name.



Figure 5.7 login interface

(v) 5.5.3 Feature set

Click on the functions setting button in the menu bar, which appears the interface as shown in Figure 5.8, which we generally recommended not to change .

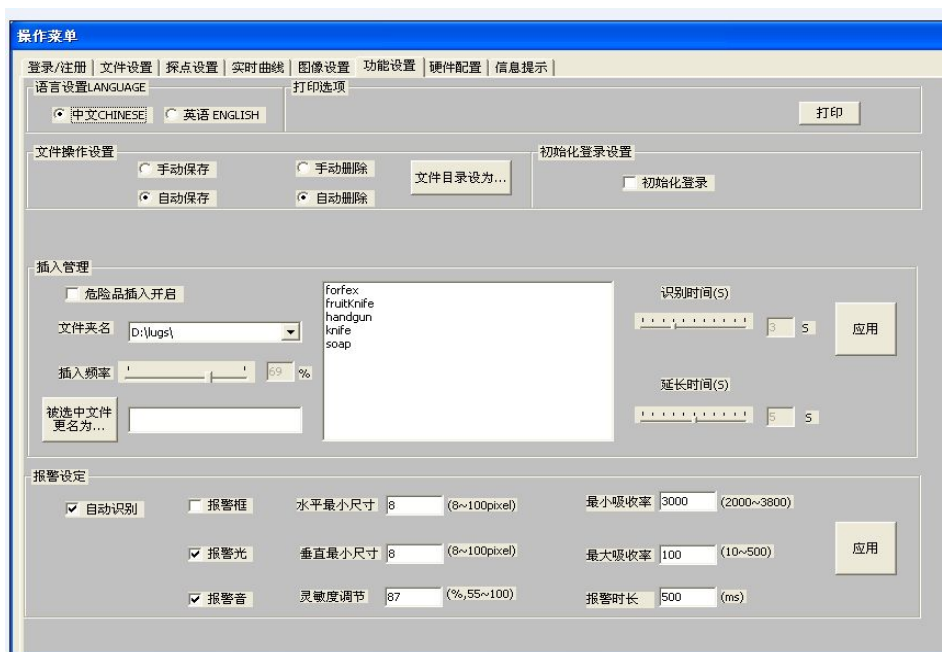


Figure 5.8 Feature set interface

(w) 5.5.4 Real-time curve

Click on real-time curve, to display the data that is collected on probe panel, this curve is a function of an auxiliary diagnostic testing, there is a certain relationship between curve data and image quality.

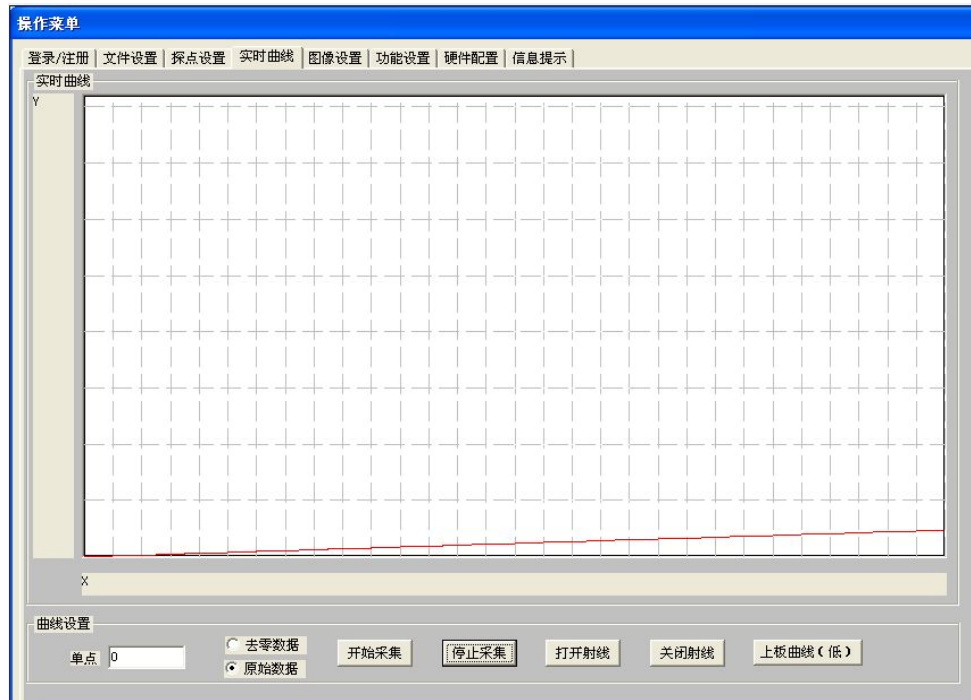


Figure 5.9 Real-time curve display

(x) 5.5.5 Image settings

Click the setting button of image, as shown in Figure 5.10, you can configure the relevant parameters of the image settings.

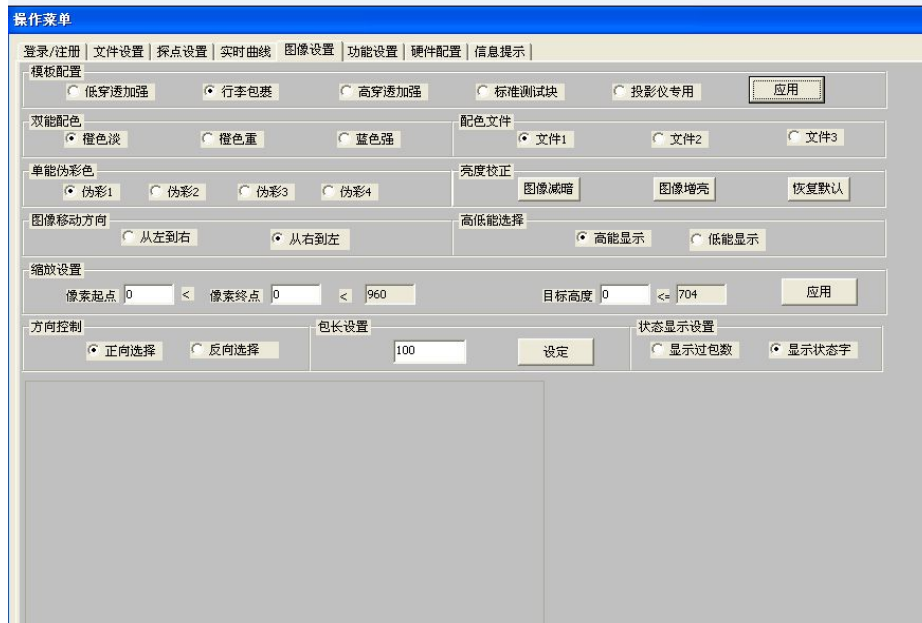


Figure 5.10 Image settings interface

(y) 5.5.6 File settings

Click the File Settings button, you can callback the history record images, according to the conditions set, you can search the original records kept.

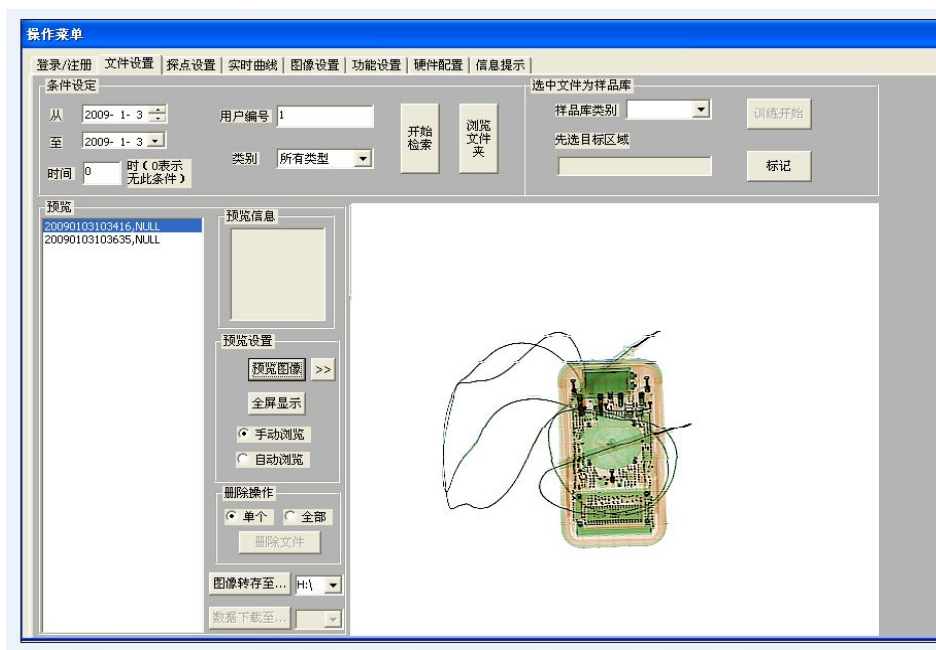


Figure 5.11 File Settings interface

(z) 5.5.7 Information tips

Click the message alert button to display corresponding version number and parcel records and other useful information.

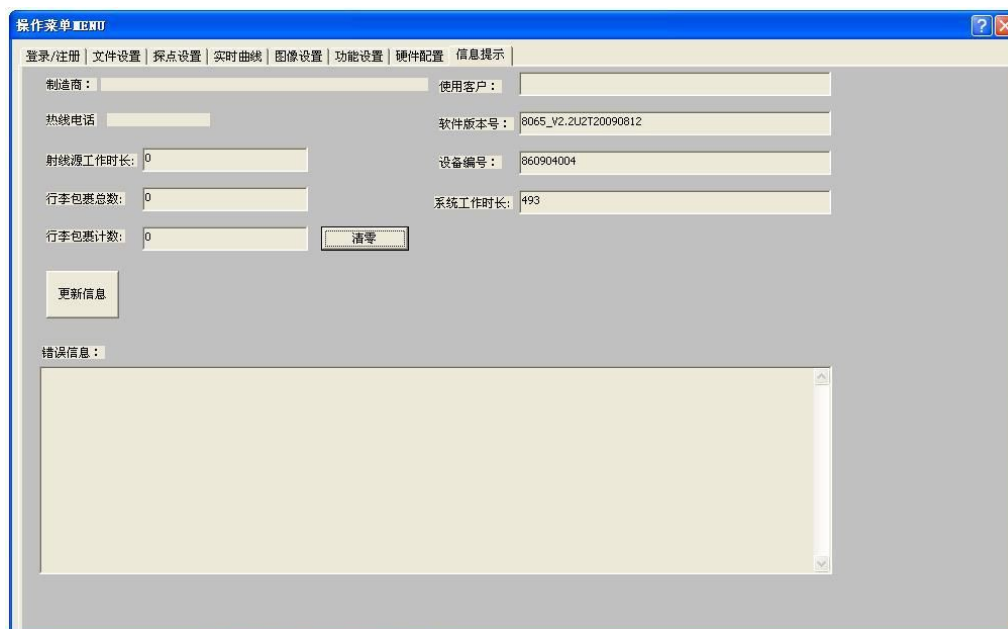


Figure 5.12 Information tips interface

5.6 Typical image

(aa) 5.6.1 Image of standard module

The three colors that color image uses are: blue, orange, green. Where blue represents iron, steel and other large atomic minerals, such as iron, steel and other metals; Orange represents the atomic number of smaller organic compounds, such as water, glass, plastic, etc.; green represents the objects between organic and inorganic, such as aluminum. Figure 5.13 is a imaging result of standard module.

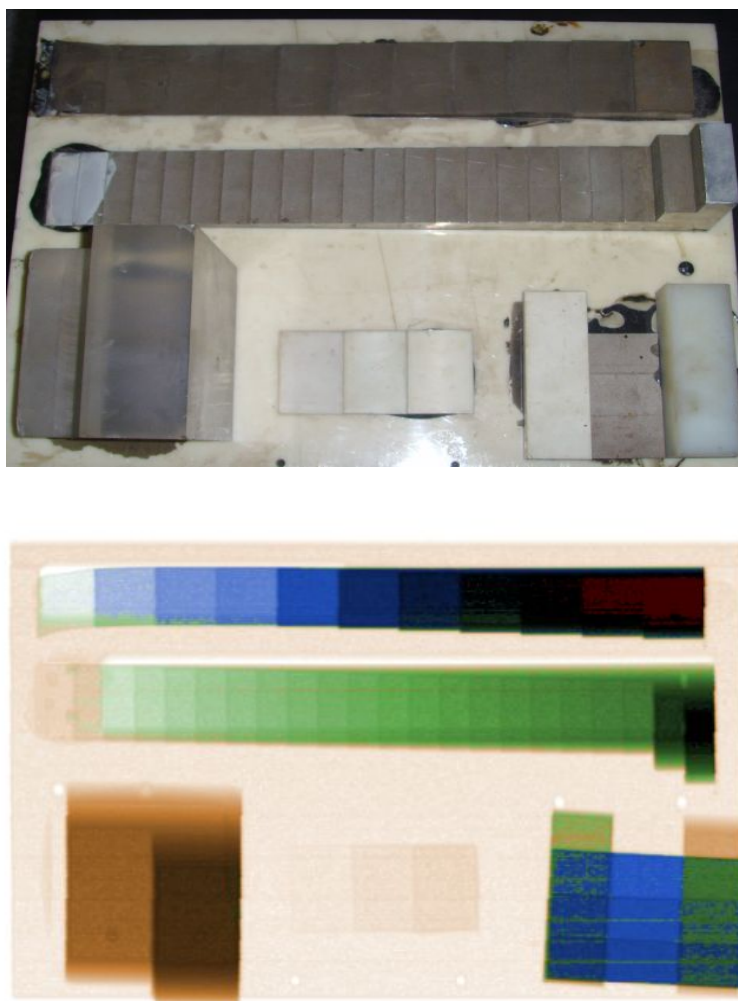


Figure 5.13 Image of standard modules

(ab) 5.6.2 Image of typical contraband

Typical contrabands include: knives, lighters, firecrackers, liquid, its imaging results shown in Figure 5.14.



Figure 5.14 Image of typical contraband

(ac) 5.6.3 Image of typical small items

Typical small items such as needles, pins, etc., the image below shows needles of various sizes. The above is real objects, below is the image, because the needle through from the white paper, the effect that seen in the real figure is missing one part among the needles, and the overall size of the needle is displayed in the imaging graph.

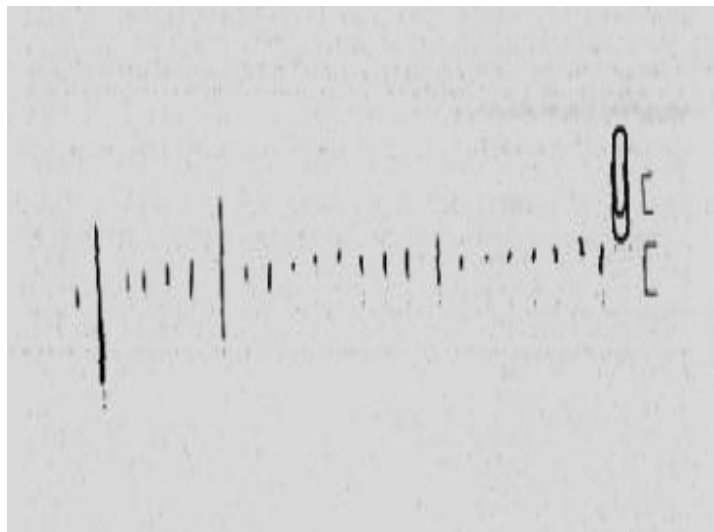
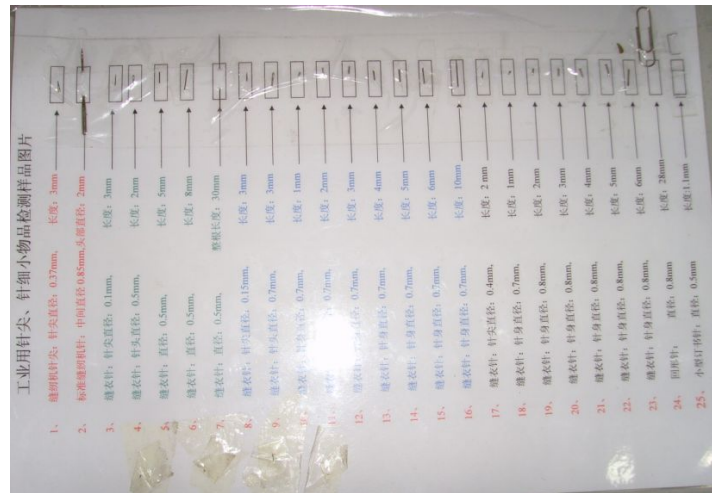


Figure 5.15 Typical images of small items

Figure 5.16 is a typical picture of small needles in his shoes (the needle is 0.3-1.0mm).



Figure 5.16 A typical picture of small needles in his shoes

VI Maintenance, repair and common troubleshoot

X-ray security inspection system is the combination of high-tech electromechanical products. Therefore, the user not only need to understand the technical performance of the machine, the structural principle and procedures, but also be good at doing routine maintenance and repair work in order to give full play to its performance, prolong life, and to ensure that equipment and personal safety.

6.1 Daily care and maintenance

In order to ensure the effective operation of the device consistent with the technical indicators in the instructions, the device should be checked regularly and make related adjustments. The maintenance work must be carried out by trained personnel with getting recognized by the company. When take hardware maintenance procedure, it should cut off the power first.

1、Normal maintenance

- Equipment should be installed in ventilation, dust less , dry environment, to avoid direct exposure to heat, moisture and sunlight .
- Before take maintenance, clear the equipment's dust firstly with brush and vacuum cleaner.
- If find the components or lugs have loosed, they should be tightened immediately.
- When there are components corrosive, it should be replaced if necessary .
- If there is damage to the components, you should identify the reasons for troubleshooting and then replaced with a new line of devices. After the device is replaced, the relevant parameters should be adjusted before being normal used.

- It is not allowed to let foreign objects or liquid get into the device during the period of maintenance, to prevent from leakage or accidents.

2、The specific contents of care and maintenance

- Check the power indicator on the device:
When the device is powered up , the green indicator will light.
- Check the X -ray indicator on the device:
When emit ray, the red indicator will light.
- Check the emergency stop button at the top of the channel:
Press the emergency stop button, the device can be powered down immediately. When the button has not reset, the device can not be started again.
- Check the key switch at the top of the channel:
After the key switch is turned on, starting the button to start the device. Ray stop button can disconnect the power of ray controller. If the key switches become sensitive, please replace them.
- Check the touch screen whether correspond to screen image:
Press the zoom button, the image can be scaled ; press key image processing button, the displayed image can be changed appropriately.
- Check inlet light barrier :
Place an opaque object on the running conveyor belt, rays can normally open. After the device is powered off, clean the lens and the glass mounted on the channel light barrier wall with a dry silk cloth.
- Check the electric roller:
Press the corresponding button, electric roller can run and stop according to the predetermined direction. The noise of roller is normal, and there is no oil leakage.
- Check the limit switches on detection box and collimator:
Remove any one cover, it is able to stop the rays launch.
- Check the belt deviation
Check whether the motor has deviated from the conveyor belt.

- Check the vents

Check the vents are blocked, and clean the dust on it.

6.2 Maintenance safety precautions

- During the repair process, it is not allowed the foreign objects, water drop getting into the device, to avoid the equipment damage or accidents.
- There are a large number of devices operating voltage of 220V devices, whose general maintenance must be carried out at the time of power off, if need to operate it with power, it must be carried out by trained personnel, and to do work against electric shock.
- Since there are a lot of sophisticated equipment electronic devices, it should do well the preparatory work to prevent the device from electrostatic damage before servicing.
- There are many lead protective layers used to prevent radiation leakage on the device, it is better to wear cotton gloves during the operation process, if the situation that not allow to wear gloves, wash your hands immediately after work.
- Check the device again before connecting power, make sure the wiring is correct, and there is nothing wrong, or short-circuited situation.
- Cover the plate before opening rays, to avoid injury caused by ray irradiation.

6.3 Replace the rollers and conveyors

- The equipment should be powered of first, then disconnect the motor cable.
- Open the cover plate, unscrew the mounting bolts of conveyor and frame, remove the conveyor.
- You can discharge and replace the electric roller or partial demolition roller by relaxing the tension bolts and loosening the belt.
- Belt replacement:
(1) cut off the damaged adhesive tape and remove it.

(2) carry out the pre-process before the cold bonding for the new adhesive tape in tape manufacturer according to the original tape's perimeter.

(3) carry out the cold bonding process for the assembled tape on site.

6.4 Replace and adjust the light barrier

Adjust the light barrier as follows:

- Disconnect the device's power, open the cover.
- Disconnect the light barrier cable.
- Unscrew the two bolts of light barrier .
- Put a new light barrier, adjust the position of the light barrier by adjusting the vertical position of the light barrier, then fix it.
- The cable outlet of the light barrier is welded with connector in accordance with the drawings.
- Connect the cables.
- Install the cover of equipment .
- Connect with the power, start the conveyor, place the opaque objects on the conveyor, to test the rays whether normally open.

6.5 Replace and adjust the X-ray source

When replace and adjust the X-ray source, it should according to the following steps:

- Cut off the system's power, remove the equipment's cover
- Disconnect the cable from the X -ray source
- Remove the fastening screws of X -ray source
- Discharge the limited block
- Loosen the adjusting bolt
- Take out the X -ray source
- Install a new X -ray source according to the above steps

- Do not tighten the screw and the limited block
- The system is powered
- Enter the " Main Menu", then enter "Device Configuration" menu
- Alternately adjust the adjustment screws and the handle on the right of the X-ray source
- After the adjustment, tighten the fastening screw and limited block of the ray source
- Power off.

6.6 Training of X-ray source

The purpose of training X -ray tube is to reduce the failure rate of the X-ray source, extend the X -ray tubes' using life and improve the reliability of the machine used. As for those standby X -ray sources for X -ray security inspection equipment that have not been used for more than six months, or have suffered bumps or excessive vibration during the transportation because of various reasons (including those X -ray sources that have been assembled and unassembled onto the machine) , must be strictly carried out training tubes in accordance with the training program. The whole site installation and re-enable the machine after an idle period, should be strictly carried out training tube of X -ray tube.

The tube training program of X -ray tube include :

- (1) During power
- (2) Initial adjustment
- (3) Training pipe
- (4) Final adjustment

6.7 Common faults and troubleshooting

This section describes the symptom may occur, causes and troubleshooting.

During the maintenance of X -ray security inspection equipment, the spare parts can only be replaced with the type that provided by our company. We do not take any responsibility for those machine failure caused by any repairs beyond our authorized or machine damage caused by the use of machine repair parts outside of my company.

We reiterate: All repairs and adjustments shall be specially carried out by qualified service personnel. The device can be powered only when all the circuit boards are in their correct position. Please note: when put out and insert the PCB, it should be sure to turn off the power. The followings are the analysis of reasons faults and troubleshooting according to the symptom.

(ad)6.7.1 Power failure

Fault 1 : The system can not be powered on

Analysis of Possible Cause:

- (1) Whether the local power is correct.
- (2) No key switch or have not connected the key switch.
- (3) Blown fuse.
- (4) Circuit breaker is in the off position.
- (5) Emergency stop switch is in the locked state.
- (6) AC contactor is damaged.
- (7) Terminal wiring loose.

Remedy:

- (1) Check the local power line within the range of $220+10\%/-15\%V$, $50\pm 3Hz$.
- (2) Plug in the key switch, clockwise to the ON position .
- (3) Replace the fuse with a new one.
- (4) Close the circuit breaker.
- (5) Clockwise to reset the emergency stop button .
- (6) Replace an AC contactor.
- (7) Check the wiring and reconnect .

Note: make sure the device is normal before the system is powered on.

Fault 2: The power light is off

Analysis of Possible Cause:

- (1) The device does not start.
- (2) Indicator cable is not connected .
- (3) Terminal wiring loose.
- (4) Lights are damaged.

Remedy:

- (1) Start the device.
- (2) Connect the LED cable.
- (3) Check the wiring and reconnect .
- (4) Replace the indicator.

Fault 3 : The system can be powered up, but it has no other functions

Analysis of Possible Cause:

- (1) The electronic controller or ray source controller power is not plugged into the socket .
- (2) The contactor KM2 is damaged.
- (3) The switching power is damaged.
- (4)The network interface cable is not connected.
- (5) The serial cable connected to the IPC is not connected.

Remedy:

- (1) Plug the electronic controller or ray source controller into the appropriate socket.
- (2) Replace the contactor.
- (3) Replace the switching power.
- (4) Connect the network interface cable to the IPC .
- (5) Connect the serial cable to the IPC.

Note : Incorrect voltage output will damage the device, should disconnect the

power in the replacement and adjustment.

(ae) 6.7.2 System control

Fault 1 : Conveyor can not run forward

Analysis of Possible Cause:

- (1) RS232 cable is not connected.
- (2) The electronic controller is damaged.
- (3) The start capacitor is damaged.
- (4) The cable loose.
- (5) The electric roller is damaged.
- (6) The conveyor belt is stuck.

Remedy:

- (1) RS232 cable is properly connected .
- (2) Replace the electronic controller.
- (3) Replace the start capacitor.
- (4) Check the cable connections, re-tighten the cable.
- (5) Replace the electric roller.
- (6) Adjust the belt .

Fault 2 : Conveyor can not be stopped

Analysis of Possible Cause:

- (1) The electronic controller is damaged.
- (2) CPU board

Remedy:

- (1) Replace the electronic controller.
- (2) Restart the IPC.

(af) 6.7.3 X -ray control

Before servicing this section, it should exclude all failures of power and system control issues, and there are two failures related to the X -ray control.

Fault 1: X -ray source does not transmit

Analysis of Possible Cause:

- (1) There is no items in the channel or the items do not block the light barrier .
- (2) The cover in the position of installing interlock switch is opened.
- (3) The power of ray source controller is not inserted .
- (4) The AC contactor is damaged.
- (5) The X -ray source is damaged.
- (6) The ray source controller is damaged.
- (7) The X -ray source cable is not connected correctly.
- (8) The light barrier is not properly connected .
- (9) The light barrier is damaged.
- (10) The electric roller is not running .
- (11) The electronic controller is damaged.

Remedy:

- (1) Place a large opaque object in the channel .
- (2) Close the cover in the position of installing interlock switch.
- (3) Plug ray source controller power.
- (4) Replace the AC contactor KM2.
- (5) Replace the X -ray source.
- (6) Replace the ray source controller.
- (7) Reconnect the cable of X -ray source.
- (8) Check the light barrier cable and connected properly.
- (9) Replace the light barrier.
- (10) starting electric roller.
- (11) Replace the electronic controller.

Fault 2: X-ray emission light does not shine

Analysis of Possible Cause:

- (1) X-ray is not emitted
- (2) The electronic control panel is damaged
- (3) The cable is not connected correctly
- (4)The ray indicator is damaged

Remedy:

- (1) Start the roller after placing items on the conveyor belt, to emit the ray
- (2) Replace the electronic control panel
- (3) Check the cable and connect properly
- (4) Replace the indicator

(ag) 6.7. 4 Image display

Before finding the faults in imaging system, please confirm that the X-ray generator on the electrical machinery has properly adjusted. Verify that the system meets the requirements of power voltage (5V, $\pm 5\%$; 12V, $\pm 10\%$).

Fault 1: the monitor screen is not bright after the system is powered up

Analysis of Possible Cause:

- (1) The power of monitor is not turned on
- (2) The signal cable of monitor is not connected

Remedy:

- (1) Turn on the monitor power
- (2) Connect the monitor signal cable

Fault 2: After IPC operation, the monitor display vertical stripes when carry out application

Analysis of Possible Cause:

(1) Signal processing board

(2) Cable

Remedy:

(1) Replace the signal processing board

(2) Replace the cable

Fault 3 : There is no images when inspect the baggages

Analysis of Possible Cause:

(1) The control panel and IPC serial cable

(2) The control panel

(3) The light barrier

Remedy:

(1) Replace serial cable

(2) Replace the control panel

(3) Replace the light barrier

Fault 4: There appears horizontal lines when inspect the baggages (note, the image has 3-6 dark lines is normal, since the belt itself has two dark lines)

Analysis of Possible Cause: detector or a sounding board .

Remedy : Replace the detector or the corresponding sounding board .

6.8 Storage conditions , storage period and precautions

The device should be discharged and installed repeatedly before its delivery.

The system should be stored in a clean and dry place, overheating and excessive humidity can damage the system components. If the device has not been used for a long-term, it should be stored in the original packaging.

Environmental conditions for equipment storage are:

1 , in the transport or storage packing state, the device must be placed within the following environmental conditions for less than 15 weeks:

Storage temperature : -20 ~ +60 °C (non-condensing);

Humidity : 20% ~ 95%;

2 , if the equipment need to be stored for a long time, it should have good storage conditions; the treasury should be clean, dry, well-ventilated; there is no corrosive gas surrounded; the relative humidity is less than 80% and the equipment should be placed in the box.

VII Service

7.1 Manufacturer guarantee

We put the technical support and after-sales service in the first place, and sincerely provide customers with quality service.

7.2 Equipment acceptance

1, the user informs of our company when receives the equipment, then we will arrange professional technical support engineers to assist in unpacking inspection, and carry out the installation and commissioning of the equipment. Technical support engineer should check carefully the device and its accessories one by one according to the order contract and packing list, based on the user responsible spirit. If there is damaged and mistakes, technical support engineers should work to assist with the claim or inform the company immediately of correcting, making up it, and carrying out the equipment installation and commissioning according to the technical specifications.

2, During the installation and commissioning of the equipment, the user should give positive cooperation in order to ensure that the system put into operation as soon as possible .

3 , Device acceptance criteria: according to the contract acceptance criteria and methods .

4 , Equipment acceptance deadline: completed the equipment acceptance within 5 days after the completion of equipment installation; user sign the acceptance report, and that day will be as the start date of the warranty period. Late company will not be liable.

7.3 Technical support and training

Technical training is divided into basic operator training and image recognition skills training. Our company provides users with free basic operator training.

1, Purpose: To enable users to understand the system configuration of the device, basically grasp the part operation of the equipment and supporting software operation. Meanwhile to make a preliminary evaluation for the quality of the arrived equipment.

2, Time: can be arranged according to users' requirements and the actual situation.

3, Location: the training principle of operation is carried out in the scene of equipment.

7.4 Service matters

Thank you for choosing our equipment, our company will provide you with quality service, which include:

1 , Choose the nearest authorized service unit for repair.

2, if there is a doubt and maintenance difficulties, please contact with your province (municipality) service center first

If the security devices are the following conditions, which are not covered by the warranty:

1, The trademark nameplate or serial number of the equipment or accessories has been torn off or modified.

2, The damage is caused by users' improper, use, maintenance, and storage.

3, Damage caused by force majeure.

4, Repaired by non-designated repair unit or dismantled without permission .

5, Combined or assembled with the parts that are not provided by our company, unless it has obtained the express written approval of our company .

II Security product certification

Thank you for your use of our following products :

Product Name: X -ray security inspection equipment

Model:

Product ID:

The model is tested strictly in accordance with the standard of “GB15208.1-2005
Micro- dose X -ray security inspection equipment”.

Conclusion: Passed allowed to leave the factory

Inspector: _____

Inspection date: day month 201 year

QC Dept.

III Security product warranty book

Thank your using our company's security products:

Device Model :

5030C ☐ Quantity ☐ set

6550 ☐ Quantity ☐ set

8065 ☐ Quantity ☐ set

10080 ☐ Quantity ☐ set

100100 ☐ Quantity ☐ set

OEM 6040 ☐ Quantity ☐ set

OEM 6575 ☐ Quantity ☐ set

During the process of the operation, please according to the manual operation to carry out it.

During the warranty period, our company repair the equipment for free .

QC Dept.

V Security products' repair list

Thank your using my company's security products:

When the device encounters a failure that your staff can not handle, in order to make you get the service in the fastest and shortest time, please fill in the following information in writing and fax it to us, we will arrange the professional and technical personnel to serve you in a shortest time, and thank you very much for your cooperation!

The detail address of the device:		
The current model of device:	Quantity:	
The current model of device:	Qunatity:	
The person in charge of the device:	Job title:	Contact:
Enable Time:		
Current equipment failure phenomenon (detailed description):		

Repair time: